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7. (Twice Amended) A solid-state image pickup device comprising:

    a substrate, provided with no wiring;

    a solid-state image pickup element chip on which a plurality of solid-state image pickup elements are mounted, said solid-state image device pickup element chip being formed on said substrate;

    a protection cap provided on a light incident side of said solid-state image pickup element chip and adapted to protect said solid-state image pickup element chip; and

    a wiring substrate formed of a flexible material and connected electrically to said solid-state image pickup element chip,

    wherein a connection between said solid-state image pickup element chip and said wiring substrate is fixed only at a bump formed on an electrode pad, and

    wherein said substrate that is provided with no wiring is made of the same material as that of said protection cap, and said substrate that is provided with no wiring and protection cap are sealed with a sealing resin, so as to form a substrate having a hollow space between said solid-state image pickup element chip and said protection cap.

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REMARKS

Claims 1, 7, 13, 14, 17, 19-21, 24 and 26-29 remain in this application. The Claims 15, 16, 22 and 23 have been canceled, and their recitations incorporated into their respective base claims, and Claims 18 and 25 also have been canceled; these actions are taken without prejudice or disclaimer of subject matter. A Letter Submitting Corrected

Drawing is submitted herewith, in response to the objection to the drawings set out in paragraph 1 of the Office Action.

Claims 1 and 7 are independent.

Claims 15, 16, 22 and 23 were rejected under 35 U.S.C. § 112, first paragraph, as not being supported by enabling disclosure in the application as filed. While these claims have been canceled, since their recitations are now contained in Claims 1 and 7, Applicants submit the following observations in traversal of this rejection.

Applicants respectfully point out the discussion in the specification, at page 6, lines 10-21, of using a TAB tape, and of attaching such a tape to the image pickup element chip. Such a tape is an example of a wiring substrate, and that fact would be familiar to a person of ordinary skill in the relevant art. Accordingly, it is believed plain that one of ordinary skill would be able to make and use the claimed invention based on what is disclosed in the application as filed, and withdrawal of this rejection is respectfully requested.

In addition, Claims 1, 7, 13, 19, 20, 26 and 27 were rejected under 35 U.S.C. § 103(a) as being obvious from Japanese Kokai 8-241976A (*Hideki*) in view of Applicants' Admitted Prior Art, specifically, Fig. 7 of the present application. Claims 14, 17, 18, 21, 24, 25, 28 and 29 also were rejected under Section 103(a) as being obvious from *Hideki* in view of the admitted prior art and of U.S. 5,138,145 (*Nakamura*) an Applicant's admitted prior art in Fig. 7.

The present invention relates to a solid-state image pickup device such as a CCD or CMOS image sensor, suitable use in a digital camera or the like, and in which a higher degree of miniaturization is achieved than has been possible conventionally.

Among other important features of the aspects of the present invention set forth in the claims, are a solid state image pickup element chip and a protection cap sandwiching therebetween a hollow structure, but not combined directly and solidly. Another important feature is that a connection between the solid state image pickup element chip and a wiring substrate is fixed only at a bump provided on an electrode pad of the chip, thereby providing a flexibility which minimizes the adverse effect of distortion due to differences between the thermal expansion coefficients of the protection cap and the solid state image pickup element chip (see the electrode pad 5 and the bump 6 in Fig. 1; it is understood, of course, that reference to this Figure is explanatory only, and that the claims are not limited to the details of the illustrated embodiment referred to).

This hollow structure provides insufficient mechanical strength to constitute a package by the solid state image pickup element chip and the protection cap only. Accordingly, a substrate of a material whose thermal expansion coefficient is at least substantially equal to that of the protection cap is bonded together the protection cap with a sealing resin, thereby constituting the package. By this means, sufficient strength for constituting the package is provided, and distortion of the structure is prevented (see the protection cap 3, the substrate 4 and a sealing resin 8 in Fig. 1).

Among additional important features is that the first-mentioned substrate is provided with no wiring. This avoids the problem that if such wiring were provided, then even if the protection cap and the substrate are made of materials having the same thermal expansion coefficient, the wiring on the substrate would tend to defeat the effect of this.

More specifically, independent Claim 1 is directed to a solid-state image pickup device that comprises a substrate, provided with no wiring, and a solid-state image

pickup element chip, on which a plurality of solid-state image pickup elements are mounted, and formed on the substrate. The device also has a protection cap provided on a light incident side of the solid-state image pickup element chip and adapted to protect the chip, and a wiring substrate formed of a flexible material and connected electrically to the solid-state image pickup element chip. According to Claim 1, a connection between the solid-state image pickup element chip and the wiring substrate is fixed only at a bump formed on an electrode pad, and the first-mentioned substrate has a thermal expansion coefficient substantially equal to that of the protection cap. Moreover, the first-mentioned substrate and the protection cap are sealed with a sealing resin, so as to form a structure having a hollow space between the pickup element chip and the protection cap..

Independent Claim 7 is directed to a solid-state image pickup device that comprises a substrate, provided with no wiring, a solid-state image pickup element chip on which a plurality of solid-state image pickup elements are mounted, and formed on the substrate, and a protection cap provided on a light incident side of the pickup element chip and adapted to protect the chip. Also provided is a wiring substrate, formed of a flexible material and connected electrically to the pickup element chip, a connection between image pickup element chip and the wiring substrate being fixed only at a bump formed on an electrode pad. Also, the first-mentioned substrate is made of the same material as is the protection cap, and that substrate and the protection cap are sealed with a sealing resin, so as to form a substrate having a hollow space between the solid-state image pickup element chip and the protection cap.

*Hideki* relates to a device having a CCD chip 32 that is electrically connected through a wire bonding 34 to a ceramic substrate 30. Even though it would

presumably be intended to make a cover glass 36 and the ceramic substrate to have the same thermal expansion coefficient, it would be difficult in practice to achieve this precisely. In addition, the CCD chip is fixedly bonded to the cover glass and the ceramic substrate through the transparent resin 38, directly and solidly without hollow space. As a result, distortion due to differences in the thermal expansion coefficients of the cover glass and the CCD chip, which is silicon, as well as distortion due to contraction upon the hardening of the sealing resin, would directly affect, and indeed would warp, the CCD chip.

Applicants submit that nothing has been found, or pointed out, in *Hideki* that would teach or suggest a structure like those recited in Claims 1 and 7, having a substrate, provided with no wiring, and a protection cap, forming such hollow space between them.

Moreover, even if Fig. 7 of the present application (showing a prior-art structure) shows a hollow structure, it should be noted that in that prior-art construction, the TAB tape 2 is solidly and fixedly bonded by means of an adhesive 10 and a sealing resin 8 to the protection cap 3 and the solid state image pickup element chip 1 at all surface area of the TAB tape 2 between the protection cap 3 and the image pick-up element chip 1, and is further bonded by means of an anisotropic conductive film 9 to the image pick-up element chip. Accordingly, the fixed-bonding area between the protection cap and the image pick-up element chip would be rather large, with the result that the adverse effects of differences in the thermal expansion coefficients of the parts within the bonding area, would be intolerable. It is submitted that one of merely ordinary skill would not have been

able to find any way in which to combine Fig. 7 with *Hideki* so as to reach either of the structures recited in Claims 1 and 7.

*Nakamura* relates to an image sensor of a type in which an image sensor chip 41 comprising plural photosensors 43 is mounted on a photohardening insulating resin 40 disposed on an upper surface side of a transparent substrate 48, and light is incident on the transparent substrate 48. Apparently, the image sensor chip and the transparent substrate are solidly bonded over their whole surface area through the photohardening resin. Accordingly, due to the differences in the thermal expansion coefficients of the materials of the bonded surfaces, adverse effects such as distortion would result. Thus, according to *Nakamura*, a flexible adhesive 40 is filled in between the sensor chip and the transparent substrate without a hollow space. Again, therefore, the resulting structure will suffer from some degree of warpage. Thus, the *Nakamura* approach cannot in any way that applicants can see, solve the technical problem addressed by the present invention. Further, the *Nakamura* structure lacks a base plate corresponding to the substrate 4 of the preferred embodiments of the present invention. In view of that, *Nakamura* fails even to recognize the technical problem that applicants have solved.

Even if combined as proposed in the Office Action, and even assuming such combination would be permissible, the structure of Fig. 7 of the present application, taken together with *Hideki* and *Nakamura* would not result in the structures recited respectively in Claims 1 and 7.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as prior art

against the independent claims herein. Those claims are therefore believed patentable over the art of record.

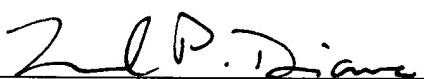
The other claims in this application are each dependent from one or the other of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

This Amendment After Final Action is believed clearly to place this application in condition for allowance and, therefore, its entry is believed proper under 37 C.F.R. § 1.116. at the very least, cancellation of Claims 15, 16, 18, 22, 23 and 25 eliminates all issues as to those claims. In any event, entry of this Amendment After Final Action, as an earnest effort to advance prosecution and reduce the number of issues, is respectfully requested. Should the Examiner believe that issues remain outstanding, it is respectfully requested that the Examiner contact Applicants' undersigned attorney in an effort to resolve such issues and advance the case to issue.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

  
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Attorney for Applicant

Registration No. 78,286 

FITZPATRICK, CELLA, HARPER & SCINTO  
30 Rockefeller Plaza  
New York, New York 10112-3801  
Facsimile: (212) 218-2200  
NY\_MAIN 303380 v1



Application No. 09/938,571  
Attorney Docket No. 03500.015701.

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Twice Amended) A solid-state image pickup device comprising:
  - a substrate, provided with no wiring;
  - a solid-state image pickup element chip on which a plurality of solid-state image pickup elements are mounted, said solid-state image device pickup element chip being formed on said substrate; [and]
    - a protection cap provided on a light incident side of said solid-state image pickup element chip and adapted to protect said solid-state image pickup element chip; and
      - a wiring substrate formed of a flexible material and connected electrically to said solid-state image pickup element chip,  
wherein a connection between said solid-state image pickup element chip  
and said wiring substrate is fixed only at a bump formed on an electrode pad, and  
wherein said substrate that is provided with no wiring has a thermal  
expansion coefficient substantially equal to that of said protection cap, and said substrate that is  
provided with no wiring and said protection cap are sealed with a sealing resin, so as to form a  
structure having a hollow space between said solid-state image pickup element chip and said  
protection cap.

7. (Twice Amended) A solid-state image pickup device comprising:
  - a substrate, provided with no wiring;

a solid-state image pickup element chip on which a plurality of solid-state image pickup elements are mounted, said solid-state image device pickup element chip being formed on said substrate; [and]

a protection cap provided on a light incident side of said solid-state image pickup element chip and adapted to protect said solid-state image pickup element chip; and

a wiring substrate formed of a flexible material and connected electrically to said solid-state image pickup element chip,

wherein a connection between said solid-state image pickup element chip and said wiring substrate is fixed only at a bump formed on an electrode pad, and

wherein said substrate that is provided with no wiring is made of the same material as that of said protection cap, and said substrate that is provided with no wiring and protection cap are sealed with a sealing resin, so as to form a substrate having a hollow space between said solid-state image pickup element chip and said protection cap.

15. (Canceled).

16. (Canceled).

18. (Canceled)

22. (Canceled)

23. (Canceled)

25. (Canceled)